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Documentation and evaluation of Depot Maintenance Cost System coding and reporting by Department of Defense depots

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THESIS

DOCUMENTATION AND EVALUTION OF DEPOT MAINTENANCE COST SYSTEM CODING AND REPORTING BY DEPARTMENT OF DEFENSE DEPOTS

by

Harry Samuel Guess, Jr.

December 1984

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Documentation and Evaluation of Depot Maintenance Cost System Coding and Reporting by Department of Defense Depots

by

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I. INTRODUCTION

A. THESIS OBJECTIVE

The purpose of this research project is to examine and document the coding process for cost data reported by the various military service maintenance depots to the Department of Defense (DOD) under DOD Instruction 7220.29. A key objective of the 7220.29 instruction is to provide DOD managers with a single accounting system that allows comparison of costs for depot organic work. However, the methods that depots use in collecting and accumulating costs are not uniform and may vary considerably. As a result this research will attempt to identify cost data variances that originate from differences in depot coding procedures.

B. HISTORY OF THE UNIFORM COST ACCOUNTING SYSTEM

A uniform cost accounting system which would encompass all service depot level maintenance activities has been a DOD objective as early as 1963. The necessity for a uniform system was twofold. First, there was a desire to tie together the wide variety of accounting systems in use across and within the individual services. Second, the aggregated costs for repair, overhaul and maintenance activities were not concise or defined well enough to support management decisions.

In 1963, directives for two separate uniform systems were promulgated. The first was DOD INST. 7220.14, "Uniform

Cost Accounting for Depot Maintenance," and the second DOD INST. 7220.9, "Depot Maintenance Production Reporting." By 1968, these two directives were consolidated and published as DOD INST. 7220.29, "Uniform Depot Maintenance Accounting and Production Reporting System." This new directive was jointly sponsored by the Assistant Secretary of Defense, Comptroller (ASD(C)) and the Assistant Secretary of Defense, Installation and Logistics (ASD(I&L)) subsequently, redesignated Manpower, Installations and Logistics (MI&L).

To comply with the Budget Act of 1950, which requires accounting systems of federal agencies to conform with Government Accounting Office (GAO) standards, the 7220.29 directive was submitted to GAO for review and approval. The GAO cited significant discrepancies in treatment of costs allowed under 7220.29 along with other control and enforcement deficiences and advised that approval would be withheld.

Acting to correct the deficiencies GAO had identified, the office of the ASD(MI&L) chartered the Joint Logistic Commanders Panel in 1972. JLC's efforts produced the guidelines for a Uniform Depot Maintenance Cost Accounting System. These guidelines were promulgated as DOD Instruction 7220.29, "Guidance for Cost Accounting and Reporting for Depot Maintenance and Maintenance Support," October 20, 1975 and 7220.29-H, "Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting Handbook." The objectives for this new uniform system were:

1. To establish a uniform cost accounting system for use in accumulating the costs of depot maintenance activities as they relate to the weapon systems supported or items maintained. This information would enable managers to compare unit repair costs with replacement cost.
2. To assure uniform recording, accumulating and reporting on depot maintenance operations and maintenance support activities so that comparison of repair costs can be made among depots and among depots and contract sources performing similar maintenance functions.
3. To assist in measuring productivity, developing performance cost standards and determining areas for management emphasis, which would enable managers to evaluate depot maintenance and maintenance support activities for efficient resource use.
4. To provide a means of identifying maintenance capability and duplication of capacity and indicating both actual and potential areas for interservice support of maintenance workload.

Although significant effort was applied to the development of a truly uniform system, longstanding differences in accounting practices among the individual services continued to impact the accuracy of the 7220.29 data base. Recognizing this, the JLC panel established the Joint Depot

Maintenance Analysis Group (JDMAG) to assist in the elimination or explanation of costing inconsistencies between the services. Some progress was achieved by the JLC Aeronautical Depot Maintenance Panel, who, working under a temporary charter, identified twenty-eight basic accounting areas of disagreement and recommended ninety-five changes to DOD INST. 7220.29-H (handbook).

In March, 1980 another group, the JLC Aeronautical Depot Maintenance Action Group (JADMAG) was established under a permanent charter to conduct an ongoing review of system implementation and operation. However, as late as April, 1981, the Defense Audit Service reported that eighteen areas of Department of Defense guidance had not been fully implemented by one or more of the services [Ref. 1]. Currently, OASD and the JADMAG continue to direct efforts at identifying and correcting deficiencies in the Depot Maintenance Cost System. In that regard, this research is a small part of the overall effort.

C. METHODOLOGY

The research for this project was accomplished primarily through a literature search and on-site visits. Source documents include DOD Instructions, studies, and reports, Naval Air Logistics Center Instructions, Air Force Logistics Command Regulations as well as local instructions, reports and brochures applicable to the Sacramento Air Logistics Center and Naval Air Rework Facility, North Island.

On-site visits and interviews were conducted at the Sacramento Air Logistics Center (ALC), Sacramento, California and the Naval Air Rework Facility (NARF), North Island, San Diego, California. These facilities were selected because they use basically different accounting systems even though they operate under similar missions in providing depot level support for aircraft. Sacramento ALC uses a process cost system as do all other Air Force ALCs while NARF, North Island uses a job order cost system just as the other NARFs do.

In spite of differences in accounting systems and service procedures, both facilities studied are required to report data into the common data base of the Depot Maintenance Cost System (DMCS) established by 7220.29. Therefore, both systems are evaluated through comparison with the data standards required for the DMCS.

The initial segment of the research provides a brief overview of both the Navy and Air Force facilities and the larger logistic systems within which they operate. The subsequent segments describe the data sources and cost systems used by each depot to provide the cost data for the DMCS, this includes examination of the coding process used to transform the data from its original source to the final format presented in the Depot Maintenance Cost System. Next, for those cost data elements reported in the DMCS, an analysis focuses on the accuracy of the data, its relevance to the Office of Assistant Secretary of Defense, and the

impact of using the cost data in the DMCS format. In the final section, major findings, conclusions and recommendations for further study are presented.

II. DEPOT MAINTENANCE SYSTEMS

A. SCOPE OF DEPOT MAINTENANCE IN DOD

Depot maintenance within DOD is defined in DOD Directive 4151.16 as maintenance which is the responsibility of and performed by designated activities. Purposes for depot maintenance would be:

1. To augment stocks of serviceable material.
2. To support organizational and intermediate maintenance activities by use of more extensive shop facilities, equipment and personnel of higher technical skill than are available at the lower levels of maintenance.

Depot maintenance phases normally comprise "inspection, test, repair, modification, alteration, modernization, conversion, overhaul, reclamation or rebuild of parts, assemblies, subassemblies, components, equipment end-items, and weapon systems, the manufacture of critical nonavailable parts, and providing technical assistance to intermediate maintenance organizations, using and other activities" [Ref. 2].

Other categories within the scope of depot maintenance include Maintenance Support (planning, engineering and technical services), Supply Support (packing and preservation) and maintenance performed by the depot even though the maintenance action is normally performed at the organization or intermediate levels.

Designated activities for depot maintenance may include:

1. Government owned-Government operated (GOGO) facilities such as an Air Logistics Center or a Naval Air Rework Facility.

2. Government owned-Contractor operated (GOCO) facility.

3. Contractor owned-Contractor operated (COCO) facility.

The Depot Maintenance Cost System includes data elements to collect costs from all three types of facilities. The focus of this study is only on data pertaining to organic (GOGO) depot costs.

B. SACRAMENTO AIR LOGISTICS CENTER

The Sacramento Air Logistics Center (ALC) is one of five ALCs providing logistic and maintenance support for the Air Force worldwide. Sacramento ALC is physically located at McClellan Air Force Base in Sacramento, California. Other ALCs are located at Air Force bases in Ogden, Utah, San Antonio, Texas, Oklahoma City, Oklahoma and Warner-Robbins, Georgia.

1. Command Structure

The five ALCs are under the command of the Air Force Logistics Command (AFLC) located at Wright-Patterson Air Force Base in Ohio. The Commander of AFLC is a four star general who reports to the Air Force Chief of Staff (COS) in Washington, D.C. For administrative matters the AFLC reports to the Office of the Secretary of the Air Force

via the Air Force COS, who in turn reports to the Office of the Secretary of Defense.

2. Mission

The Sacramento ALC has a two-fold mission of providing industrial type maintenance, supply, and contracting services for an assigned geographic area between 90 degrees east longitude and 150 degrees west longitude except Alaska and worldwide logistics support for assigned weapons systems, equipment and commodity items [Ref. 3]. It should be noted that an ALC has system management responsibilities that are distinct from the ALC's repair and maintenance responsibilities. For Sacramento ALC, system management responsibilities include nine major aircraft and 231 electronics systems/programs and 11 major projects (see Appendix A for detailed listing). Actual maintenance responsibility for Sacramento includes the EF/F/FB-111, A-10, F-4, F-106 and CT/T39 aircraft [Ref. 3]. The result of this two-fold mission is that in many cases, the system or item manager who is responsible for obtaining support for an item (e.g., system, aircraft) and the maintenance activity tasked to provide industrial maintenance (depot level) support are both under the command of the same ALC.

3. Organization

The organization structure for Sacramento ALC is representative of other ALCs. The four directorates (Material Management, Distribution, Contracting and

Manufacturing, and Maintenance) comprise the Primary Logistic Center organization. The Material Management Directorate is responsible for system management of assigned items and as a function of that management identify and schedule items for rework/repair by the Maintenance Directorate. Actual depot maintenance work is performed within one of the four product divisions of the Maintenance Directorate. Each division is further divided into branches, sections, and resource control centers. The Distribution Directorate provides supply support including receiving, material processing, preservation, packaging storage and issue, and other essential functions to provide the quick and total distribution of goods to its worldwide customers [Ref. 3].

Sacramento ALC and its host facility, McClellan AFB, employ nearly 18,000 people and is the largest employer in the Sacramento area. In 1983, $446.5 million was spent in support of the ALC mission. Through the Directorate of Contracting and Manufacturing, $2.1 billion in contracts were awarded in 1983 with the following distribution: $265.1 million to small businesses, $8.0 million to minority businesses, and $3.1 million to women-owned businesses [Ref. 3].

4. Management Control Systems

Management control at Sacramento ALC is exercised through thirty depot maintenance data systems (see Appendix B). Of these thirty systems the four major cost accounting systems are used to manage and control cost. The Depot Maintenance Budget and Management Cost System provides the

Operating Cost Based Budget (OCBB), one of the primary management tools used at the ALC. The OCBB is developed mechanically based on planned labor application (anticipated requirements) and operating cost data (current year cost). All cost data input to the OCBB is extracted at the Resource Control Center level (cost center), which is the lowest level of cost collection in an ALC. Once aggregated, the OCBB allows performance management at three levels: the organizational (by RCC), the product (individual job orders) and by cost element (direct labor, direct material).

From a higher perspective, the Air Force Logistics Command exercises budget control over its ALCs through the Industrial Fund Rate Structure. AFLC may modify each ALC's proposed labor and overhead rates as needed so that the overall Air Force Industrial Fund has a zero profit/loss. These modifications are then applied to provide stable rates to all customers throughout the coming year. (Refer to Appendix C for Industrial Fund definition.)

In addition to the comparison of actual cost against budgeted cost, ALC managers are provided labor hour standards for each job. These are compared to actual production labor hours, thereby measuring labor efficiency.

Management reports on labor productivity (productive hours as a percent of total hours) are issued to supervisors daily from the Labor Distribution and Cost System. For material costs, the Actual Material Cost System records

direct material costs associated with production jobs, plus indirect and overhead material costs by Resource Control Center.

Finally, all costs are accumulated in the Production Cost System which records both actual cost by job order number, and end-item sales price based on stabilized rates. The actual costs are then fed into the ALC version of the Depot Maintenance Cost System, the "Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting System."

C. NAVAL AIR REWORK FACILITY, NORTH ISLAND

The Naval Air Rework Facility (NARF), North Island is one of six NARFs providing depot maintenance support for Naval Aviation. NARF North Island is physically located at the Naval Air Station (NAS) North Island in San Diego, California. Other NARFs are located at Naval Air Stations in Alameda, California; Pensacola, Florida; Jacksonville, Florida; Norfolk, Virginia; and at the Marine Corps Air Station (MCAS), Cherry Point, North Carolina.

1. Command Structure

The six NARFS are under the administrative command of the Naval Air Logistics Center (NALC) in Patuxtent River, Maryland. The NALC is responsible to the Naval Air Systems Command (NAVAIRSYSCOM) in Washington, D.C., for overall coordination and management of the Navy's aviation depot maintenance programs. NAVAIR SYSCOM, under the Chief of

Naval Material (CNM) has responsibility for planning, budgeting, and oversight of all logistic programs for Naval Aviation. This includes weapon system acquisition and program management which are NAVAIRSYSCOM's primary function since depot maintenance programs are managed through NALC. The Chief of Naval Material (a four-star admiral) reports to the Chief of Naval Operations (CNO) for management of all Navy logistics programs, including all depot maintenance activities (shipyards, NARFs, ordnance facilities). For administrative matters regarding logistics the Chief of Naval Material reports (via the CNO) to the Office of the Secretary of the Navy (OSN) who in turn reports to the Office of the Secretary of Defense (OSD).

2. Mission

The NARF North Island mission is to provide higher level industrial type maintenance to assigned weapons systems and equipment. For NARF North Island this may include performance in support of the following program categories:

A. Air frame rework under the Standard Depot Level Maintenance (SDLM) concept;

B. Modification of airframes, engines, and aircraft components and systems;

C. Repair and retrofit of improvements to aircraft engines;

D. Repair and overhaul of aircraft components and systems;

E. Manufacturing of designated parts, including the design and production of authorized equipment modification kits;

F. Aircraft support service functions, including such items as overhaul and repair of Ground Support Equipment (GSE), calibration of test equipment, and aircraft salvage;

G. Miscellaneous related programs including shipboard work, missile component repair, installation of capital equipment and Navy Engineering support.

Specific aircraft overhauled at NARF North Island include F-14 and F-4 fighters, E-2 early warning aircraft and H-46 logistic helicopters. In the future, NARF North Island's mission will include overhaul of the Navy's newest fighter, the F/A-18 [Ref. 4].

3. Organization

The Naval Air Rework Facility North Island is staffed and operated by 29 military personnel and approximately 5500 government civilian employees making it the largest of the NARFs (Navy Industrial Fund Financial and Cost Statements, June, 1984). Under the direction of its Commanding Officer (Navy Captain: O-6), NARF North Island is organized along the functional lines of production activity and support activity. The first echelon of management under the Commanding Officer is assigned to military officers who exercise top level management over several departments. Each department may be further subdivided into divisions, branches, sections, and units or shops.

At the top management level, organizational control is primarily distributed into the following three areas:

A. Production. Under the Production Officer there are three departments providing production services for the

NARF. The Production, Planning and Inventory Control Department plans and controls workload by both aircraft and components. The Production Engineering Department provides engineering analysis and technical support. The Production Department performs the actual depot level maintenance on assigned systems.

B. Management Services. The Management Services Officer provides overall guidance for three departments that contribute administrative and management support for the NARF. The Administrative Services Department offers general administrative and office management services including Public Relations and Public Affairs support. The Management Controls and Comptroller Department is responsible for developing and maintaining an effective management control system and providing a full range of budget and accounting services including the Depot Maintenance Cost System (DMCS). The Material Department produces material management and support for the production and support departments of the NARF.

C. Quality Assurance. The Quality Assurance Officer assesses the quality and reliability of NARF output through two departments; the Quality and Reliability Assurance and Flight Test Departments. The Quality and Reliability Assurance Department provides analysis and verification of the quality of NARF output by aircraft and component. The Flight Test Department is responsible for all aspects of flight check operations.

4. Management Control Systems

Management Control at NARF North Island is exercised through several complementary systems including budgets, performance reports, and key performance indicators. Perhaps the most widely used control tool is the operating budget.

The NARF budget is developed from projected workload inputs from NALC. From the projected workload estimates are developed for direct hours, and expected costs related to workload accomplishment. At the headquarters level (NALC) NARF's budget estimates are used to develop stabilized rates that support a zero profit/loss in the overall Navy Industrial Fund (see Appendix C for Industrial Fund Definition).

Once an approved budget is provided, monitoring and control is facilitated by quarterly inputs in the form of financial and cost statements. These reports include a statement of revenues and costs, a breakdown of revenues and costs by product line, analysis of net operating results, analysis of operations, man-hour comparisons and many others.

The NARF also provides an operational report and the three section Production Performance Report (PPR) to NALC and NAVAIRSYSCOM. Section A of the PPR (Schedule and Completions) and Section C (Summary, Program, Manhours, Cost and Supplemental Information) are submitted monthly while Section B (Production, Manhours, and Cost) is submitted on a quarterly basis [Ref. 5].

A third method of control is executed through the monitoring and reporting of thirteen key performance indicators. These thirteen indicators, listed in Table 2.1, were originated by NALC and are coupled to goals with broad ranges. The NARF reports progress reflecting actual performance against the established goals on a monthly basis. Finally, all costs are accumulated by product (job order) in the NARF financial data base and then extracted for reporting depot maintenance costs through the Depot Maintenance Cost System.

TABLE 2.1

Key Performance Indicators

Treasury Cash

Activity Cash

Materials and Supplies

Accumulated Operating Results

Labor Hours

  Regular Direct

  Overtime Direct

  Regular Indirect

  Overtime Indirect

Productive Ratio

Total Costs

Revenue

Personnel on Board

  Full Time Permanent

  Temporary

Source: Naval Aviation Logistics Center Letter 810/7000/17328 of 17 October 1983

III. DEPOT CODING PROCESS

This section discusses the processes used by depots to collect and code data that is reported to the Depot Maintenance Cost System (DMCS). To support its cost accounting system, DOD requires each depot to maintain a data record for each type of depot maintenance work performed. These data records encompass each single customer on a job order covering one item or a group of the same items. Each data record consists of several of the fifty data fields that have been established to describe maintenance related activity and record their associated costs. Appendix D lists the fifty data fields.

The first eight data fields are related to Record Identification and are used primarily to identify the activity reporting the maintenance action, and the time period (fiscal year and quarter) when maintenance was completed. These fields are relatively standard and most coding is done by automated data systems. "Owner Operator Code" (field seven) is used for identifying interservicing (work performed by one military service for another service) and can have a significant impact on interservice costs reported to OASD. However, interservice cost reporting and the DMCS is the subject of another thesis and is not directly addressed in this research.

The next seven data fields (9-15) are used to: 1) identify the item on which depot maintenance was performed; 2) indicate the type of maintenance provided; and 3) identify the customer (agency billed for the work). These data fields are critical to OASD's ability to identify and aggregate costs by weapons systems.

Actual cost data for each record is contained in fields 17-44. This research focuses on cost data in Fields 17-35 where organic depot costs for labor, material, and overhead are collected. Data fields 36-42 provide costs from contractor facilities, for interservice work, or non-depot maintenance activity cost. Finally, fields 45-50 contain production data reflecting the number of completed items inducted for the year, and previous years, along with the average number of work days that items were in process.

The coding process used by Sacramento ALC and NARF North Island are described separately (Sections A and B respectively) for each of the four data element sections: Record Identification, Item/Service/Customer Identification, Labor Hours and Cost, and Production. Contrasts and comparison of ALCs & NARF's coding process is discussed in Section C and summarized in Table 3.1. Contrasts are identified in terms of information bias or "noise" introduced by the process. To the extent that noise is introduced through the coding process the data in the DMCS is affected. In some cases noise is minor, in others, significant. In addition, noise

may have a positive or negative impact on both the local and DOD cost systems.

A. SACRAMENTO ALC

Sacramento ALC uses thirty standardized depot maintenance systems to extract data for the DMCS. The Directorate of Material Management (customer) and the Directorate of Maintenance (depot maintenance activity) being under one command, allows for a significant amount of integration among the planning, material, production and cost systems involved. As a result, most of the data elements required for the DMCS are derived from automated systems.

1. Record Identification (Fields 1-8)

Although the Air Force Cost System is characterized as a process cost system, a job order number system is used to accumulate costs for both billing and DMCS purposes. The nine digit job order number is the source for the fiscal year and program element codes (Fields 3 and 4). The job order number originates in the planning and requirements system. A Planner (GS-9-11) establishes and manually inputs the job order number and other workload information into the Job Order Production Master System G004L. The record type, quarter code, facility name, inside/outside U.S. code and Reporting Facility code (Fields 1,2,5,6,8) are all standardized fields automatically loaded into the Sacramento ALC version of the DMCS, HO36A "Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting System."

2. Item/Service and Customer Identification (Fields 9-15)

During the same planning and requirements process that generates a job order number, source information pertaining to item identification and type of repair description is developed. The Item Manager (IM) starts the processes by initiating a repair requirement form AFLC 801 that provides item identification by item name, national stock number or federal supply class, weapon system application, and unit cost. In addition, the Item Manager (customer) assigned responsibility for the item is identified on the form. Fields 9, 10, and 11 (item ID, item name, and standard price) are coded from this information which is put into the Job Order Control System G004L by the Item Manager (GS-9-11).

Data field 12 reflects weapon or support system codes. ALCs employ weapon system coding tables provided by the Air Force Logistics Command. However each ALC interprets these tables locally. This data field is critical to arraying depot maintenance costs by weapon system and is the subject of a separate thesis research. See Reference 6 for detail on this field.

In addition to the Item Manager data, the planning process is dependent upon pertinent Source of Repair (SOR) data from the maintenance workloader who provides data that reflect the type of work to be done (e.g., overhaul, repair maintenance) the organization responsible for the work, and the type of item to be worked on (e.g., aircraft, engine or

component). The data reflecting type of work, type of item receiving maintenance, and item ownership (by service) are integrated in the job order number (positions 5, 6 and 9 respectively). Once integrated into the JON, the data flows through the Job Order Control System (G004L) and, ultimately, into the local DMCS file (H036A) where it is reflected in Fields 13, 14 and 15: work breakdown structure, work performance category and customer code.

3. Labor and Cost Data (Fields 17-35)

a. Overview

Cost Accumulation at an ALC is by Resource Control Center (RCC) for labor and overhead costs, while direct material costs are charged directly against a job order number. At the RCC, or cost center level, labor costs are segregated through the use of Duty Codes (DC). These duty codes allow the system to identify how each employee's time has been utilized (e.g., direct production, indirect, leave) RCCs are also identified by type of work (production, G&A), thus separating accumulation of production costs from general administrative costs.

In order to tie the accumulated labor and overhead costs of the RCC to a job order number, a production standards system is used as an allocation base. For each maintenance action represented by a JON there are labor hour standards that have been developed for that maintenance action. Based upon an actual count of production in each

RCC earned hours for each JON are computed (from the Product of Production Count times Standard Hours) by RCC. These earned hours form the allocation base for RCC Labor and Overhead Costs to be distributed to a JON. Once costs are accumulated by JON this data can be tied to Record and Item Identification Fields that are also linked by JON in the local DMCS file H036A.

This is a general overview of the cost accumulation process. As each data field is discussed, more detail of the systems and processes involved is provided. In addition, Figure 3.1 depicts those data systems involved in cost accumulation at ALCs.

b. Direct Civilian Labor (Production) Cost and Hours (Fields 17-18)

As stated previously, labor costs are accumulated by RCC and duty code. Each civilian employee is identified in the Maintenance Labor Distribution and Cost System (GO37G) by RCC (the individual's shop or office) and by duty code. Labor hours continually accumulate for each individual according to the assigned duty code and RCC unless a change or exception is entered via the Remote Data Collection System GO14. An exception Clerk (GS-3-5), under the direction of an RCC supervisor, enters duty code changes (e.g., from direct production to indirect) and reassignments to RCCs into the GO37G using a GO14 data terminal. These exceptions or changes represent the only manual input into the system once an employee file is established. The cost for

each labor hour recorded is computed by the G037G using civilian labor rates from the H002 Civilian Payroll Systems. This system also accelerates labor costs to reflect the government costs for civilian employee benefits. As stated earlier, these direct labor hours and cost are allocated to individual job order numbers and, subsequently, transferred into the H036A (local depot version of the DMCS).

c. Direct Civilian Labor (Other) Cost and Hours (Fields 19-20)

These fields are not used by the ALC to record depot level costs.

d. Direct Military Labor (Production) Cost and Hours (Fields 21-22)

Military labor hours and costs are collected and coded in the same manner as civilian labor. Labor system distinction between military and civilian labor is accomplished by use of a separate set of duty codes for military. Military pay rates are fed into the G037G Labor Distribution and Cost System from the H069 military payroll system.

e. Direct Military Labor (Other) Cost and Hours (Fields 23-24)

These fields are not used to record depot level costs at the ALC.

f. Direct Material Costs, Funded and Unfunded (Fields 25-29)

Direct material requirements are identified to the job order number representing the maintenance action.

When material is required for a job it is requisitioned from the Maintenance Inventory Center (MIC) on an AFLC Form 244. The 244 Form is generated by a product support person (GS-3-5) from a data terminal that inputs the National Stock Number (NSN) required, quantity, job order number, and other accounting and cost codes into the Depot Stock Control and Distribution System (D033). The D033 system will authorize a material issue at the current inventory carrying price in the system. The issued material costs and the associated job order number are then passed by D033 to the Material Cost System G004H. The G004H accumulates direct material costs by JON and, subsequently, passes this data through the system to the H036A.

This process applies to both funded and unfunded direct material requirements. The distinction between funded and unfunded is determined by the original funding source of the material and within the D033 system by the stock number account coding. Funded items are procured through a stock fund account that requires reimbursement (from another funding source) at the time of material issue. Unfunded items are procured through an Appropriation Purchases Account (APA) and require no reimbursement from the user when issued. Generally, funded items represent consumable type items that will not be repaired when unserviceable; whereas, unfunded items represent a significant investment and are normally repaired when unserviceable.

g. Other Direct Costs, Funded and Unfunded (Fields 30-31)

These fields are manually coded by a GS-9 accountant. They reflect non-depot labor/material costs directly related to a product (job order) such as travel or contracted engineering support. The unfunded field would reflect similar service categories that were provided by military personnel.

h. Operations Overhead, Funded and Unfunded (Fields 32-33)

Operations Overhead Data is extracted from the material (G004H) and labor (G037G) cost systems and allocated through the Depot Maintenance Budget and Management Cost System (G035A). The G035A contains a Production Administration Table that specifies the allocation of costs accumulated by Production Support RCCs to Direct Production RCCs. This allocation is based upon the actual direct labor hours of the production RCC. The production RCCs total operations overhead cost is then allocated to job order numbers based on earned hours (Standard Hours times Production count) by the Depot Maintenance Production Cost System (G072A). The G072A subsequently transfers this information to the H036A (local DMCS).

The coding of data for operations overhead is the same as that used for direct labor and direct material recording. The assignment to an indirect duty code causes the labor system to accumulate what will ultimately be

operations overhead costs. In the material system, the presence of an accounting code representing the requesting Resource Control Center identifies the material as an overhead cost.

Military labor and unfunded material items would be separately identified and accumulated through the same process to produce data in the unfunded field.

i. General and Administrative Expense, Funded and Unfunded (Fields 34-35)

G&A overhead costs are accumulated and coded using the same processes and systems as described for operations overhead. Distinctions between G&A and operations overhead costs are made by Resource Control Center. Certain G&A costs, such as base support, are identified by their own pseudo G&A Resource Control Centers. Depreciation to recoup funds required to replace capital equipment is also included in G&A. These costs (depreciation and base support costs) are manually coded by a GS-9 accountant and entered (by data terminal operator) into the G035A Budget and Management Cost System for allocation with the other overhead costs. Additional detail on overhead cost accumulation at ALCs and NARFs is provided in Reference 8.

j. Maintenance Support Costs Organic, Funded and Unfunded (Fields 43-44)

Maintenance Support Costs (organic) are a third level of specific overhead costs. These costs are accumulated in Psuedo RCCs and allocated in the same manner as Operations

Overhead Costs. Funded Maintenance Support includes the costs for planning, scheduling, and quality assurance while the unfunded costs represent Item Manager's support (funded by the Directorate of Material Management) and accounting services for those contracts in support of maintenance.

4. Production Data (Fields 43-44)

The production data fields report the total number of inducted items completed for the year and previous years. This is not coded data but a count of records for inducted items that were completed. The H036A system computes and maintains totals for these fields as job orders are completed and passed into the system (H036A). The average days work in process total is controlled by status codes assigned to each job order number. When a job is in process, it is identified by a 0 Status Code. Once the job is completed, a Status Code 1 is assigned allowing computation of the number of days in process. The entry of daily production count into the G004L job order production master system determines when a job is completed.

B. NARF NORTH ISLAND

The job order accounting system used by NARF North Island is designed to compile detailed labor material and other costs (by product) necessary for Navy Industrial Fund (N.I.F.) accounting, and at the same time, collect data required for the DMCS.

Job orders are categorized as either "direct" or "indirect" and are further distinguished as "specific" or "standing"

based upon the type of work involved. Figures 3.2 and 3.3 provide examples of direct and indirect job orders. Direct job orders are used to identify costs to an end product and indirect job orders are employed to accumulate costs that cannot be identified with or readily assignable to an end product. Specific job orders are issued when the work is to be performed within a stated timeframe while standing job orders are established to record indirect work on a continuing basis [Ref. 9].

1. Record Identification (Fields 1-8)

The second or third digit of the direct JON (varies with program--aircraft, engines) identifies the fiscal year and quarter of induction (Fields 2 & 3). The record type, Program Element, facility name, inside/outside U.S. code, and reporting facility codes (Fields 1,4,5,6,8) are all program-generated as standard fields into the DMCS report compiled by the NARF. Field 7, Owner Operator Code is generally not used by NARFs to report Interservicing Costs. Reference 7 provides specific detail on this field. The opening and initial coding of JONs may be either A) automatically coded for aircraft and engines through an automated workload control system, B) manually coded for production indirect and general expense job orders (done by GS-9-11 Financial Analysts), or C) manually coded for component rework as required.

2. Item/Service and Customer Identification (Fields 9-15)

The item ID number, item nomenclature, standard inventory price and work breakdown structure code (Fields 9,10,11,13) are all extracted from Type Model Series Tables built into the local Depot Maintenance Cost System by using the customer code (Field 15), type model, and item ID codes contained in the job order number. This process is sufficient for the majority of items. However, data are input manually when required by the Financial Analysts of the Comptroller Division. The Work Performance Code (Field 14) is extracted from a Type Model Series Table in a similar fashion using program and sub-program codes of the JON (see Figure 3.2). Field 12, the Weapon or Support System Code is interpreted and coded based upon local NARF Instructions. Reference 6, a thesis research on Weapon System coding, provides specific details.

3. Labor and Cost Data Fields (17-35)

a. Overview

NARF North Island records labor hours and costs through a source data automation system that uses transactor data terminals, located in each cost center. Transactions are entered into the system by the use of a "Man Identity Card," which contains the employee pay number and a job card which contains the link number and other data relevant to the product on which the employee is working. The link number provides the connection back to the direct job order

while the employee pay number is used to identify such things as the employee's shift, pay rate, start and stop time and lunch, in the personnel file.

Material charges are identified to job orders (direct and indirect) by the NAVAIR Industrial Material Management System (NIMMS). NIMMS is a mechanized information system that is the source of all material expenditure data. Actual labor, material, and other costs are accumulated in the NIF Financial System and data to support a separate data base for the local DMCS (referred to as UCA at NARFs) are extracted from the NIF System. Quarterly and annual reports required for the DMCS are compiled from the local DMCS data base.

b. Direct Civilian Labor (Production) Cost and Hours (Fields 17-18)

The Source Data Automation (SDA) system accumulates direct production costs and hours against the last entered job order transaction until a new transaction is entered. The system also accumulates costs and hours at the employees normal pay rate and work hours (8 a.m. to 5 p.m. less normal lunch and break times) unless the shop supervisor enters exception data (overtime, leave, training). All exceptions continue to accumulate until cleared by the responsible supervisor. Supervisors are provided with a daily listing of each employee's hours worked (including overtime) and the job order the time was charged against. When the report has been audited for validity of items

such as job order numbers and overtime, the supervisor signs and dates the report for return to the cognizant cost clerk.

c. Direct Civilian Labor (Other) Cost and Hours (Fields 19-20)

Data for these fields are accumulated by the Source Data Automation (SDA) system for direct civilian labor of G&A cost centers provided to a specific job order. When specific G&A cost centers like Production Planning and Control and Quality Assurance provide direct efforts to job orders the costs are against that job. The financial system distinguishes the charge from direct labor by the cost center coding of the production job order number.

d. Direct Military Labor (Production) Cost and Hours (Fields 21-22)

The Source Data Automation (SDA) transactor system is used for military labor accumulation in the same manner as for civilian labor. The most common application for direct military labor would be in flight testing aircraft. The employee pay number for military requires the system to use a separate pay table reflecting comptroller of the Navy composite rates for military.

e. Direct Military Labor (Other) Cost and Hours (Fields 23-24)

Data for these fields are provided by the SDA using the same coding process and criteria as for civilian labor (other).

f. Direct Material Costs Funded and Unfunded (Fields 25-29)

All material requests identify the job order against which the material is to be charged. The NIMMS will then charge the job order with the current inventory price for the requested item. For standard stock (NSN) items material price updates can be processed on a daily basis. For non-standard material (non-NSN) the receipt price is used for material costing. Material that is manufactured locally by the NARF is carried at the average price of the total inventory for that item.

Unfunded material consists of government furnished and Appropriation Purchases Account (APA) items that do not require reimbursement to the Industrial Fund. The NIMMS distinguishes this material by a two-digit cognizance code that precedes the NSN on the material request form. Routine material requests are coded by a Supply Clerk (GS-4) while an Equipment Specialist (GS-9) would handle exceptions.

g. Other Direct Costs Funded and Unfunded (Fields 30-31)

The cost data in these fields reflect non-depot labor and material costs directly related to a job order such as travel or contracted engineering support. These fields are manually coded for input by an Accrual Accountant (GS-9).

h. Operations Overhead, Funded and Unfunded (Fields 32-33)

Operations overhead costs are accumulated by the labor and material systems previously discussed. Costs are

charged against standing job orders that may represent shop supervision, bulk, pre-expended bin material usage and costs transferred from non-production cost centers (e.g., tool room issue). While the actual costs are accumulating, a pre-developed rate (from the operating budget) is applied based upon direct labor hours charged against a product (through a direct job order). This preadjusted rate is adjusted quarterly and a year-end reallocation is applied to direct job orders if the variance between actual and applied is greater than one percent.

Military labor and unfunded material items charged against the indirect job orders capturing production overhead would be reflected as unfunded operations overhead.

i. General and Administrative Expense, Funded and Unfunded (Fields 34-35)

G&A overhead costs are accumulated and coded using the same process and systems as employed for operations overhead. Distinction between G&A and Operations Overhead Cost are made by the Standing Job Order code and Cost Center code in the standing indirect job orders. General expenses other than labor and material, are manually coded by a cost accountant (GS-9). Expenses in this category include depreciation. Unfunded G&A would include military labor and depreciation on buildings which are used by, but not owned by, NARF North Island.

j. Maintenance Support Costs (Organic), Funded and Unfunded (Fields 43-44)

North Island uses the Work Performance Category (WPC) codes to identify maintenance support costs. Work Performance Category (WPC) codes P-Programming and Planning Support; Q-Maintenance Technical and Engineering Support; R-Technical and Engineering Data; and S-Technical and Administrative Training are identified in the Type Model Series Table using the JON codes. Job order costs associated with these WPC codes are then identified as maintenance support costs in the local Depot Maintenance Cost System data base.

4. Production Data (Fields 45-50)

The production data fields provide information that is used to produce a mechanical count of the records for inducted items that were completed. The Job Order file contained in the NIF Financial System contains fields for item induction date and item completion date (Julian date calendar). The Depot Maintenance Cost System extraction uses these fields to select completed items and compute work days in process. Records are then selected based upon NSN or Item ID number, Work Performance Category and Customer Code for computation of average work days in process (WIP). This computation takes (for each record) the product of the number of days in process times the number of items covered by the job order to yield total WIP days per record. The WIP total for all records with the same item ID is then averaged to produce field 50.

C. SUMMARY

1. Record Identification (Fields 1-8)

Sacramento ALC and NARF North Island employ automated data systems that generate most record identification elements required for Fields 1-8. Sacramento ALC, by having item managers under the same command as the depot performing maintenance, is able to integrate the requirements system of the item manager (customer) with the workload planning system of the depot. In comparison, NARF North Island's requirements are primarily generated externally by the Naval Air Logistics Center (NALC) or Item Managers (components) of the Naval Supply System. As a result of the external source of requirements, coding of data elements begins at the NARF with the establishment of job order numbers reflecting record identification elements for Fields 1-8.

Both ALC and NARF systems appear to provide the required data elements without injecting biases. The exception is Field 7, Owner Operator Coding interpretation at NARF North Island. Owner Operator Code 4, which identifies interservice costs, is not used by NARF North Island to identify work done for NARF North Island by other depots. The impact of this interpretation is unreported interservice costs within the Depot Maintenance Cost System. Reference 7 provides additional details and analysis of data keyed to this field.

2. Item/Service and Customer Identification (Fields 9-15)

Coding processes employed by both depots Fields 9-15 are the same as those used for the Record Identification fields. The job order number in both systems supports extraction of the required data from automated systems and files. Again, one exception was noted in terms of procedure. Field 12, Weapon or Support System Code, is interpreted and coded in accordance with Air Force Logistic Command Instructions applicable to all ALCs. Within the Navy, NARFs interpret and code Field 12 in accordance with local directives. DOD 7220.29 does not specify all codes that may be used, but requires that the coding system used be submitted to OASD. Reference 6 provides additional detail and comparison across services for this data field.

3. Labor and Cost Data (Fields 17-35)

Automated cost accumulation and coding systems are used extensively by both depots. The coding processes identifying material costs and other direct costs to job order numbers are very similar. However, differences in the frequency of standard material (NSN) price updates could bias cost data used for product level comparisons. Sacramento ALC indicated material price updates occurred at least annually and as often as monthly, in some cases. NARF North Island reported material price updates could occur daily as price changes were promulgated from the source of supply. In comparing products repaired by more than one depot, standard

material prices are assumed to be the same for each depot. This assumption may be invalid if current price changes are not registered in the systems of both depots.

A significant data variation generated by coding processes was noted in labor cost allocation. As stated previously, Sacramento ALC allocates direct labor hours based on Standard Labor Hours for each product (job order number). In contrast, NARF North Island collects actual hours by job order number. The impact of the labor allocation process can be detrimental in regard to data variation biases that may be introduced. Chapter IV documents and illustrates the potential data biases that may occur through this allocation process.

4. Production Data (Fields 45-50)

NARF North Island and Sacramento ALC both code job order number records to track work days in process and number of items completed. The processes used are nearly identical and no data variations were noted.

ANNUAL UCA DATA
by Activity Group

H036B

QUARTERLY UCA DATA
by Depot

H036A

TOTAL COST
by Job Order

G072A

TOTAL PRODUCTION RCC COST
TOTAL COST BY RCC

G035A

BASE SUPPORT
& MISC. G&A COSTS
by Pseudo RCC

EARNED HRS BY RCC
ACTUAL HRS/COSTS BY RCC & DC

MATERIAL COST
by RCC/JO

G037G

G004H

LABOR RATE

EXCEPTION HRS

EARNED HRS
by Product/RCC

H002

G014

Employee #
DC/RCC

G004L

G037E

Production Count

Source: Depot Maintenance Automated Data Systems

Figure 3.1 Air Force Depot Maintenance Cost Flow

Job Order Number

Customer Code

0 3 A 01 24

Program; e.g., Aircraft

Fiscal Quarter Inducted; e.g., 3rd Qtr

Model Code (TMS); e.g., F4S

Sub-program Code; e.g., Overhaul

Serial Number; e.g., 24th aircraft of lot inducted

Local Unique Component Code (Pgm 3 only)

Source: Adapted from NAVAIREWORKFACINST 7650.1D

Figure 3.2 Direct Job Order Structre

Job Order Number

7 B 2 CC 00

Standing Job Order Code; e.g., General Cost Center
(6 = Prod. Indirect; 9 = Absence)

Cost Center Code; e.g., Mgmt Cntrl Dept
(Numeric for Production Division)

Division Level; e.g., Comptroller Division
(Branch Level for Production Indirect)

Functional Cost Code; e.g., Budgeting

Assigned by Comptroller for specific purposes

Source: Adapted from NAVAIREWORKFACINST 7650.1D

Figure 3.3 Indirect Job Order Structure

TABLE 3.1

Depot Coding Comparisons

	Fields 1-8 Record ID	Fields 9-15 Item ID	Fields 17-44 Labor and Cost Data	Fields 45-50 Production
ALC Process	Primarily automated from requirements system and JON elements. Permanent continuous type work is automated, temporary type work is opened manually.	Automated coding from requirements system and JON coding. Coding originates with item manager & maintenance workloader.	Labor automatically accumulated by cost center and allocated to JON based on labor standards for each job. Overhead allocated on same base. Direct material and other direct costs manually coded with JON.	Automatically accumulated based on status codes assigned to the JON.
NARF Process	Primarily automated from JON elements. Aircraft & Engines are automated, components are manual.	Coding of job order' number used to extract Fields 9,10,11,13 from built-in data tables. Other fields direct from JON. Coding begins with planners and financial analyst.	Labor automatically accumulated by JON. Overhead allocated based on pre-determined rate and direct labor hours. Direct material and other direct costs manually coded with JON.	Automatically accumulated based on Induction and Completion dates in the job order file.
Variation	NARF does not use Owner Operator code 4 to report Interservice costs.	ALCs interpret & code Field 12 in accordance with AFLC Insts. NARFs interpret & code by local instructions.	ALC allocation process for labor may bias labor costs from actual expended. Different material price updates may bias cost comparison by product.	No variation noted.

IV. ANALYSIS OF DEPOT MAINTENANCE COST SYSTEM (DMCS) VARIATIONS

A. OASD OBJECTIVES AND USE OF DMCS DATA

In the previous chapter, the coding processes used to transform raw data into the required 7220.29-H format were described, and those processes that potentially introduced biased data were identified. This chapter examines the data variations and the potential biases that may appear in the DMCS reports.

At the DOD level, the DMCS data is displayed in a series of 14 data tables comprising the DD-M(A) 1397 report. A listing of these tables is provided in Appendix E and a description of each table that references the data fields used is contained in Appendix F.

The DMCS collects data that is used by DOD managers in analyzing weapon system costs, as well as maintenance depot productivity and efficiency. Other specific management uses are listed in Appendix G. To the extent decision making is based on data transmitted through the Depot Maintenance Cost System, it is important that managers understand those biases that may be present in the information displayed.

B. EVALUATION OF DEPOT CODING PROCESS VARIANCES

Examination of the coding processes used by Sacramento ALC and NARF North Island yields two areas where coding transformation may generate cost data variations into the

Depot Maintenance Cost System. The data sources of the coding transformation are found in: 1) Direct Labor (Production) Fields 17, 18, 21, and 22; and 2) Material Costs, primarily Fields 25-29. Both potential variance sources are examined separately.

1. Direct Labor (Production)

Basic differences in cost accounting processes account for the variations produced for direct labor. Sacramento ALC allocates the direct production labor hours of a cost center (RCC) to job orders based upon the standard labor hours associated with the job order, while NARF North Island accumulates actual direct labor hours against the individual job order. The purpose here is not to conduct an interservice comparison but to examine those coding processes that change the cost data reported to OASD. Since the DMCS requirement is for actual direct labor hours and cost, a labor hour/cost variation may be produced when employing the ALC allocation process.

Tables 4.1, 4.2 and 4.3 present hypothetical data to demonstrate the possible bias that can be introduced. Under the job order system, the actual hours expended to products A and B would equal the actual hours charged to their respective job orders and reflected in the DMCS. However, the allocation of direct hours, based upon predetermined standards for the job, is only accurate when the ratio of actual hours per job to total actual hours per Resource Control Center

equals the ratio of standard hours per job to total standard hours per Resource Control Center. The example in Table 4.1 lists two products (A & B) that require actual labor hours that vary from the Standard Hours established to complete each product. To better demonstrate the impact of the potential allocation bias, other allocation processes proposed or in use by ALCs are also presented using the same two products. The intent of the example is to illustrate the data variations that can be introduced through the allocation process. Table 4.1 lists for each product two skills required to produce that product. Electrical and mechanical standard hours and actual hours for each skill and each product are specified. The skills for each product are combined to get a product total and the two products are combined to obtain a Resource Control Center (RCC) total. In the first example product A has a 10% unfavorable variance of 5 hours over the standard while product B has a 10% favorable variance of 10 hours over the standard for a net 5 hour (or 3.3%) favorable variance for the RCC. The 5 hour favorable variance is then allocated based upon the ratio of standard hours associated for each product over the total standard hours for the RCC (50/150 for product A and 100/150 for product B). This results in the overall 5 hour (3.3%) favorable variance being applied to each product in accordance with its percentage of total standard hours. Thus, 1/3 of the 5 hour favorable variance (1.7 hrs.) is applied to product A's 50 hour standard resulting in an

allocation of 48.3 hrs. (50-1.7) while 2/3 of the 5 hour favorable variance (3.3 hrs.) is applied to product B's 100 hour standard yielding an allocation of 96.7 (100-3.3). Contrasting the allocated hours against the actual hours reveals the significance of the bias introduced. The allocated hours for product A are 48.3 (as compared to 55 actual) and result in a 12.1% (6.7 hrs.) favorable variance from the actual hours. Product B receives an allocation of 96.7 (as compared to 90 actual) reflecting a 7.4% (6.7 hrs.) unfavorable variance from the actual hours used.

In order to reduce the variation that may be induced through the allocation of direct labor, the ALCs have proposed an allocation process based upon skill level (e.g., electrical, mechanical) within the RCC. Under this proposed process it is believed that variations can be better isolated and subsequently more accurately allocated. This new process uses an allocation ratio of the total standard hours per product by skill level divided by the total standard hours per Resource Control Center by skill level. Table 4.2 expands the hypothetical data used in Table 4.1 to illustrate the effect of the skill level allocation. In the example presented the skills for each product are combined to produce a skill total for each skill. The allocation process is applied in a similar manner as in the first example but using a ratio of standard skill level hours. Hence, the favorable variance (of 7 hrs.) for the electrical skill is applied to product A based on the ratio of 20 hrs/85 hrs and to product B

based on the ratio of 65/85. For the electrical skill this results in an allocation of 18.35 hours (as compared to 18 actual hrs.) for product A and 59.65 hours (as compared to 60 actual hrs.) for product B. This process is also applied to the mechanical skill hours for each product. The skill allocations are then recombined for each product as demonstrated. The product allocations using skills as a base, result in 49.27 hours (as compared to 55 actual) for product A and 95.73 (as compared to 90 actual) for product B. Using this process, the unfavorable variance is precisely identified to a single skill employed for product A. As a result, the product variance is more accurately reflected in the allocation by a factor of approximately 15%. In spite of the improvement, a considerable bias still exists since the inefficiency of product A is understated by 10.4% and the efficiency of product B is understated by 6.3%.

The degree of allocation variance is ultimately determined by the accuracy of the standards. The Air Force requires that the standards be updated at least every two to three years. The labor hour standard accuracy is further influenced by frequency of occurrence factors. Briefly, the frequency of occurrence factor represents the expectation that a particular maintenance action or material item will be required. In application, a frequency of occurrence factor of 50% would reduce one standard hour (at 100% occurrence) to one-half hour as the standard. The frequency

of occurrence is applied to the individual tasks of a job (e.g., remove cover) as opposed to the overall job (e.g., repair engine).

Table 4.3 presents data reflecting the allocations using standard hours adjusted for frequency of occurrence (listed as new standard). In this example, the allocation for product A is based on the new ratio of 45 product A Standard Hours over 138.5 Total Standard Hours. This ratio is used to allocate the overall 6.5 hour unfavorable variance to product A. The product B ratio would be 93.5 hours/138.5 hours. The resulting allocation is 47.12 hours (as compared to 55 actual) for product A and 97.88 hours (as compared to 90 actual) for product B. In the case presented, the Frequency of Occurrence Factor caused an increase in the variance between actual and standard hours. The Frequency of Occurrence factor could easily have resulted in a decrease in the variance using another example. This example was only for illustration of allocation methods.

Reviewing each of the data tables (4.1, 4.2, 4.3), a consistent pattern of bias is displayed in each of the examples provided as well as in additional analysis of similar data. The bias is that products with higher labor hours and favorable to neutral variances are always overstated in terms of the actual labor hours and conversely products with unfavorable variances are always understated in terms of the actual labor hours allocated.

The impact of these allocation biases may be seen in the DMCS with: 1) new items or weapons systems undergoing maintenance that are more likely to have untested and inaccurate standards since the unique "learning curves" for that new system cannot initially be built into the standards. Some amount of time lag will always exist between the learning experience and adjusting standards. 2) Established items that have been encountered at the maintenance activity on a frequent basis and are more likely to have fairly accurate standards.

Although the potential for bias generated by the allocation process has been demonstrated, actual labor cost systems like those employed by NARFs may contain data biases as well. These biases can be introduced through simple human errors (e.g., not clocking off a job when work is interrupted or completed). However, this research focuses solely on bias introduced through the coding process and does not address bias generated through other management control and cost accumulation processes.

2. Material Costs

Material costs for National Stock Number (NSN) items should be standard across all services if valid costs are to be developed and compared among depots. Material costs used by both Sacramento ALC and NARF North Island are the current inventory prices of record in their respective automated material systems. The

potential for data variation exists due to differences in the frequency of material price updates. Because of differences in services procedures, material price update frequency ranges from daily to annual. These frequency differences leave open the possibility that one depot's costs may reflect a recent price change while another depot's costs reflects a different cost (the old price) for the same item. Further study including a sampling of depot prices for select NSNs will be necessary to determine the impact of these variances.

TABLE 4.1

Comparison of Actual Vs. Allocated Direct Labor

	Standard Hours	Actual Hours	Allocated Hours
Skill			
Product A (Elec)	20	18	--
Product A (Mech)	30	37	--
Product Total	50	55	48.3
Product B (Elec)	65	60	--
Product B (Mech)	35	30	--
Product Total	100	90	96.7
RCC TOTAL	150	145	145.0

	Variance As a % of Standard	Variance from Standard Hours	Variance as a % of Actual	Variance from Actual Hours
Product A	10(U)	5(U)	12.1(F)	6.7(F)
Product B	10(F)	10(F)	7.4(U)	6.7(U)
Total		5(F)		-0-

$$\text{Allocation Base} = \frac{\text{Standard Hrs Per Product}}{\text{Total Standard Hours Per RCC}}$$

TABLE 4.2

Comparison of Actual Vs. Allocated Direct Labor (Skill Level)

Skill/Product	Standard Hours	Actual Hours	Allocated Hours
Elec Product A	20	18	18.35
Elec Product B	65	60	59.65
Skill Total	85	78	78.00
Mech Product A	30	37	30.92
Mech Product B	35	30	36.08
Skill Total	65	67	67.00
RCC TOTAL	150	145	145.00
Product A (Elec)	20	18	18.35
Product A (Mech)	30	37	30.92
Product Total	50	55	49.27
Product B (Elec)	65	60	59.65
Product B (Mech)	35	30	36.08
Product Total	100	90	95.73
RCC TOTAL	150	145	145.00

Variance	Variance as a % of Standard	Variance from Standard Hours	Variance as a % of Actual	Variance from Actual Hours
Product A	10(U)	5(U)	10.4(F)	5.7(F)
Product B	10(F)	10(F)	6.3(U)	5.7(U)
TOTAL		5(F)		-0-

$$\text{Allocation Base} = \frac{\text{Standard Hours Per Product By Skill}}{\text{Total Standard Hours per RCC by Skill}}$$

TABLE 4.3

Comparison of Actual Vs. Allocated Direct Labor
(Frequency of Occurrence)

	STANDARD HOURS			ACTUAL HOURS	ALLOC BY RCC
SKILL	OLD STD	FREQ	NEW STD		
Product A (Elec)	20	.75	15	18	--
Product A (Mech)	30	1.00	30	37	--
Product Total	50		45	55	47.12
Product B (Elec)	65	.90	58.5	60	--
Product B (Mech)	35	1.00	35.0	30	--
Product Total	100		93.5	90	97.88
RCC TOTAL	150		138.5	145	145.0

	Variance as a % of Standard	Variance from Standard Hours	Variance as a % of Actual	Variance from Actual Hours
Product A	22.2(U)	10(U)	14.8(F)	8.2(F)
Product B	3.7(F)	3.5(F)	9.0(U)	8.2(U)
Total		6.5(U)		-0-

$$\text{Allocation Base} = \frac{\text{Standard Hours Per Product}}{\text{Total Standard Hours Per RCC}}$$

V. CONCLUSION AND RECOMMENDATIONS

This section briefly summarizes the findings of the study, provides recommendations for DMCS improvements and offers suggestions for additional research.

A. SUMMARY AND FINDINGS

The purpose of this research was to document and evaluate coding processes used by depots in accumulating cost data for the DMCS. A secondary objective was to identify cost data changes that resulted from differences in coding processes. Both depots studied employ several automated depot management systems to provide information to their respective services, and the DMCS. In general, these systems provide valid and accurate coding of the data. However, in the process of accumulating and transmitting data the following transformations were noted as causes for data variation in the Depot Maintenance Cost System:

1. NARF North Island does not report interservice costs through owner/operator code 4. Reference 7 provides details.

2. NARF North Island interprets weapon or support system codes (WSSC) locally. ALCs follow AFLC regulations in interpretation of WSSC coding. This lack of consistency hampers cost comparison of weapons systems among depots of different services (and potentially among NARFs). Reference 6 provides additional details.

3. Depots are not regulated at the DOD level regarding price change updates. Hence, one service or depot may charge a more current price than another depot charges for the same item.

4. Labor hours and costs at ALCs are allocated based on standard hours and may not be an exact representation of actual costs.

B. RECOMMENDATIONS

1. Given that a consistent labor cost bias may exist, it is recommended that a study be undertaken to identify if the bias results in significantly different costs than that generated by actual cost systems in the other services. To achieve this, OASD should first specify those products for which cost comparison is possible. The second step is to measure the bias in the labor hour allocation for the selected product. This involves collection of actual labor hours to compare with the allocated labor hours as was demonstrated in Tables 4.1, 4.2, and 4.3 of the previous chapter. However, ALC accumulation of actual labor hours by product would only be necessary for a small number of products selected for the comparison by OASD. Regardless of the method used to accumulate actual cost, the effort that identifies or eliminates the potential allocation bias will enhance the credibility and comparability of ALC product level costs to product level costs of other DOD depots.

2. The commonality of National Stock Number material prices charged to components and end-items repaired by two or more facilities requires confirmation. National Stock Number (NSN) material is procured and stocked by agencies of the Department of Defense (DOD) and the General Services Administration (GSA) and then resold or issued to government

agencies at standard prices. As discussed in Chapters III and IV, the frequency of material price updates may vary widely from depot to depot. The result of different update frequencies is that the current (NSN) standard price for material may not be the price used for costing material issued for jobs in process at the depot. Unit cost analysis of items repaired by more than one depot, would be enhanced if material cost variances generated by differences in price updates were identified.

C. QUESTIONS FOR ADDITIONAL RESEARCH

In addition to the recommendations made above, the following questions are offered as topics for additional research to enhance the scope of this report:

1. What coding variations are generated by contractor operated depots? How are the variations different from those of organic depots presented in this research? Knowledge of coding processes employed at contractor operated depots would assist managers in product cost comparisons between organic and contractor depot maintenance by identifying variations in data reported into the DMCS.

2. Is it cost effective to code actual labor costs for all products? Does the allocation process used by ALCs offer significant cost savings when compared to the actual labor cost collection systems used by NARFs and other service depots?

D. CONCLUSION

This study attempted to determine if the coding procedures and processes employed by depots generated biased data that was then reported to the Depot Maintenance Cost System. The coding processes used by both depots studied can and do transform certain elements of the raw data collected. When data transformations occur at the depot level, data variances may be generated in the Depot Maintenance Cost System. The knowledge that data may be biased by a transformation process is only the first step in solving a problem of data variance. What is required now is development of methods that will identify and segregate individual records that contain data biases.

APPENDIX A

SACRAMENTO ALC PROGRAM RESPONSIBILITIES

MANAGEMENT

MAJOR AIRCRAFT

EF-111 Electronic Warfare Fighter

F-111 Tactical Fighter

FB-111 Strategic Bomber

A-10 Specialized Close Support Aircraft

C-12 Attache' Aircraft

F-100 Super Sabre

F-105 Thunderchief

T-39 Sabreliner

T-33 T-Bird

MISSILE AND SPACE

Space Support Program

Defense Support Program

GM16/LV3, Atlas Booster Program

AF Satellite Communications System

Space Transportation System (Space Shuttle)

Drone Tracking Control System

Defense MET Satellite Program

Consolidated Space Operations Center

NAVSTAR Global Position System

Electronic Warfare

COMMODITIES

Ground Radar Units

Airframe Components for Assigned Aircraft

Electronics and Electrical Components

Ground Communications Components

Airborne & Ground Generators

COMMUNICATION-ELECTRONICS

231 Systems/Programs

11 Projects

REPAIR

TECHNOLOGY REPAIR CENTER

Ground Communications-Electronics (CE) Equipment

Electronics Components

Hydraulics/Pneudraulics Fluid Driven Accessories

Flight Control Instruments

AIRCRAFT

F-11

FB-111

F-4

F-106

A-10

CT/T-39

APPENDIX B

DEPOT MAINTENANCE DATA SYSTEMS

REQUIREMENT SYSTEMS:

D039	Equipment Item Requirements Computation System
D041	Recoverable-Consumption Item Requirement System
D073	Repair Requirement Computation System
G019C	MISTR Requirements, Scheduling and Analysis System

MATERIAL SYSTEMS:

D049	Master Material Support Record System
D033	Depot Supply Stock Control and Distribution System
G005M	Depot Maintenance Material Support System

PRODUCTION SYSTEMS:

E046B	Labor Standards Mechanization System
G004I	Periodic Scheduling and Control for Equipment and Personnel
G004L	Job Order Production Master System
G014	Remote Data Collection System
G037E	Mission, Design and Series (MDS)/Project Workload Planning
G037G	Maintenance Labor Distribution and Cost System
G056	Maintenance Quality Assurance Data System

COST SYSTEMS:

G004B	Project Order Control System
G004C	Workload Programming, Planning, and Control System
G004H	Maintenance Actual Material Cost System
G035A	Depot Maintenance Budget and Management Cost System
G072A	Depot Maintenance Production Cost System
H036A	Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting System (ALC)
H036B	Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting System (HQ AFLC)

OTHER INTERFACING SYSTEMS:

D032	Inventory Manager Stock Control and Distribution System
E046A	AFLC Standard Data System
G001C	Maintenance Data Collection System
G004K	Maintenance Facility Master Plan System
G017	Depot Plant Equipment Program System
G028	Maintenance Engineering Data Support (MEDS) System
G037F	Mission, Design and Series (MDS)/Project Workload Analysis Planning System
G072C	Depot Maintenance Program and Long Range Planning System
G098	Maintenance Requirements Data System (For Analytical Interval Determination)

APPENDIX C

INDUSTRIAL FUND DEFINITION

Industrial Funds are revolving funds used to finance industrial and commercial type activities. Within DOD there are five Industrial Funds, one for each military service (Army, Navy, Air Force, Marine Corps) and a Defense Industrial Fund that supports the Defense Clothing and Textile Center and leased communications procured by the Defense Communications Office.

In basic concept a revolving fund commences operations with an initial funding by Congress; which sets up a corpus, as it is called, representing initial capitalization. Having received an initial funding, the Industrial Fund Activity then takes orders for work from customers, performs the work with dollars from the corpus of the revolving fund, bills the customers for the work, and receives reimbursement from the customers (from their appropriated money). The reimbursement would theoretically put the corpus of the revolving fund back where it started.

To support the Industrial Fund customers' need to budget for industrial work, the concept of stabilized rates was introduced. Each Industrial Fund has a centralized manager who uses individual industrial fund activity budgets to develop stabilized rates that will support a zero profit/ loss in the overal Industrial Fund.

DOD considers Industrial Fund accounting to be a management tool that allows more effective management through use of the industrial fund customer's funds as well as those of the industrial fund activities.

APPENDIX D

LISTING OF DATA RECORD FIELDS

FIELD NO.	DESCRIPTION OF DATA
	RECORD IDENTIFICATION
1	Record Type "F"
2	Quarter Code
3	Fiscal Year Identification of Facility
4	Program Element
5	Facility Name or Code a. Organic Activity Name b. Contractor Activity Code
6	Inside or Outside U.S. Code
7	Owner/Operator Code
8	Reporting Facility Code
	IDENTIFICATION OF ITEM/SERVICE AND CUSTOMER
9	Item Identification Number
10	Item Nomenclature
11	Standard Inventory Price
12	Weapon or Support System Code
13	Work Breakdown Structure Code
14	Work Performance Category
15	Customer Code
16	Unused
	LABOR HOUR AND COST DATA
17	Direct Civilian Labor (Production) Cost
18	Direct Civilian Labor (Production) Hours
19	Direct Civilian Labor (Other) Cost
20	Direct Civilian Labor (Other) Hours
21	Direct Military Labor (Production) Cost

FIELD NO.	DESCRIPTION OF DATA
22	Direct Military Labor (Production) Hours
23	Direct Military Labor (Other) Cost
24	Direct Military Labor (Other) Hours
25	Direct Material Cost--Funded
26	Direct Material Cost--Unfunded (Investment Items at Full Price)
27	Direct Material Cost--Unfunded (Exchanges)
28	Direct Material Cost--Unfunded (Modification Kits)
29	Direct Material Cost--Unfunded (Expense)
30	Other Direct Cost--Funded
31	Other Direct Cost--Unfunded
32	Operations Overhead--Funded
33	Operations Overhead--Unfunded
34	General and Administrative Expense--Funded
35	General and Administrative Expense--Unfunded
36	Contract/Interservice/Non Depot Maintenance Activity Cost
37	Government Furnished Material (Investment Items at Full Price)
38	Government-Furnished Material (Exchanges)
39	Government-Furnished Material (Modification Kits)
40	Government-Furnished Material (Expense)
41	Government-Furnished Services--Funded
42	Government-Furnished Services (Unfunded)
43	Maintenance Support Costs Organic--Funded
44	Maintenance Support Costs Organic--Unfunded

FIELD NO.	DESCRIPTION OF DATA
	PRODUCTION DATA
45	Total Production Quantity Completed
46	Unused
47	Quantity of Completed Items Inducted During Reporting Year
48	Quantity of Completed Items Inducted During Year
49	Quantity of Completed Items Inducted During All Other Previous Years
50	Work Days in Process

APPENDIX E

1397 REPORT TABLES

APPENDIX F

DESCRIPTION OF DATA TABLES

There are fourteen data tables generated from the data submitted by each Service, reflecting that Service's depot maintenance and maintenance support efforts. Some of these tables reflect total costs and production efforts while others provide information on individual facility costs and production. Significantly, many of these tables provide cost and production information at the weapon system or support system, end item, and component level. The fourteen Service tables are discussed in the following paragraphs.

TABLE 1

Displays total depot maintenance costs, including maintenance support. The breakout of costs for this table is at the major commodity level (e.g., aircraft, missiles, ships).
The table further breaks down commodity group costs to those costs borne by the depot industrial funds of the Services (funded costs) and to those costs provided for through other appropriations such as military labor, modification kits, and exchange items (unfunded costs); both funded and unfunded costs involve labor, material, overhead, and G&A, among other costs.
Commodity group is determined by the first position of the Work Breakdown Structure Code field (position 79; field 13).
The funded and unfunded columns are determined as follows:

Funded = Fields 17+19+21+23+25+30+32+34+36+41+43

Unfunded = Fields 26+27+28+29+31+33+35+37+38+39+40
+42+44

Total = funded and unfunded (sum of preceding two columns)

TABLE 2

Depicts costs by major commodity group within the different program elements used to pay for depot maintenance and maintenance support. Again, both funded and unfunded costs are identified.

Commodity group and funded/unfunded are determined as described in Table 1. Program element is determined from positions 5-9 (Field 4).

TABLES 3, #A, and #B

Table 3 identifies total costs by facility type within the major commodity groups, also showing the funded and unfunded portions of these costs. Tables 3A and 3B subdivide Table 3 into the costs of depot maintenance and maintenance support, respectively.

Facility types 1, 2, 3, and 4 are defined as codes 1, 2, 3, and 4, respectively, in Field 7 (Owner/Operator Code). Commodity group and funded/unfunded are defined as in Table 1. Table 3A, covering depot maintenance work, only, is limited to cases in which Work Performance Category (WPC), position 82 (Field 14), is coded A through N; Table 3B, covering maintenance support work, is limited to cases with WPCs of P, Q, R, S, or T.

TABLE 4

Provides performance statistics on selected Type 1 Facility (organic depot maintenance activities) performance within the Service being reported on. The following statistics are generated for each facility selected:

A. Total Cost = Fields 17+19+21+23+25

B. Percent of Total Cost that is Funded =

$$\frac{\text{Fields } 17+19+21+23+25+30+32+34+43}{\text{Fields } 17+19+21+23+25 \text{ to } 44}$$

C. Civilian Labor Cost Per Hour = $\dfrac{\text{Fields } 17+19}{\text{Fields } 18+20}$

D. Material Cost Per Labor Hour = $\dfrac{\text{Fields } 25+26+27+28+29}{\text{Fields } 18+20+22+24}$

E. Productive Indirect Costs Per Labor Hour =

$$\frac{\text{Fields } 32+33}{\text{Fields } 18+20+22+24}$$

F. General and Administrative Costs Per Labor Hour =

$$\frac{\text{Fields } 34+35}{\text{Fields } 18+20+22+24}$$

G. Direct Material Cost to Direct Labor Cost Ratio =

$$\frac{\text{Fields } 25+26+27+28+29}{\text{Fields } 17+19+21+23}$$

H. Productive Indirect Costs (Operations Overhead) to Direct Labor Cost Ratio =

$$\frac{\text{Fields } 32+33}{\text{Fields } 17+19+21+23}$$

I. General and Administrative Expense to Direct Labor Cost Ratio =

$$\frac{\text{Fields } 34+35}{\text{Fields } 17+19+21+23}$$

TABLE 5

Displays costs (funded and unfunded) by facility, within the four facility types, and by major commodity group. Facility, facility type, and major commodity group are defined as in previous tables.

TABLE 6

Structures and portrays the costs incurred at organic depot maintenance activities (Field 7, Owner/Operator Code, is equal to 1). It also identifies the total labor hours expended at each organic activity. As in previous tables, facility name is determined from Field 5.

The figures in the hour and cost columns are computed as follows:

Labor Hours = Fields 18+20+22+24

Direct Labor Cost = Fields 17+19+21+23

Direct Material Cost = Fields 25+26+27+28+29

Other Direct Cost = Fields 30+31

Maintenance Support Cost = Fields 43+44

Production Indirect Cost = Fields 32+33

G&A (General & Administrative) Cost = Fields 34+35

Total Cost = Fields 17+19+21+23+25 to 35+43+44
(sum of preceding six columns)

TABLES 7, 8, and 9

Provide cost breakdowns for activities other than organic depot maintenance. Table 7 reports on organic non-depot

maintenance activities (Field 7, Owner/Operator Code, is equal to 2), while Tables 8 and 9 cover contractor (Code 3) and interservice (Code 4), respectively. Facility name or code again comes from Field 5.

The cost figures in the columns are defined as follows:

Contract = Field 36

GF (Government Furnished) Material = Fields 37+38+39+40

Government Furnished Service = Fields 41+42

Maintenance Support = Fields 43+44

Total = Fields 36+37+38+39+40+41+42+43+44
(sum of preceding columns)

TABLES 10 and 11

Provide the first look at cost by end item, identifying individual weapon and support system costs by commodity (as defined in previous tables) and work performance categories (position 82). The costs (funded and unfunded) reflected in Table 10 include WPCs other than those accounting for maintenance support works (i.e., Codes A through N in position 82 are included). Table 11 is limited to maintenance support WPCs (Codes P, Q, R, S, T). The first column in the tables, a code identifying the individual system, is determined by the Weapon or Support System Code (Field 12); a conversion list must be used to generate a name for the system.

TABLE 12

Identifies work done, by item nomenclature (Field 10) and identification number (Field 9)--often the FSC or FSN--where the average unit cost expended for maintenance exceeded the inventory or stock list price carried in official records. The items are aggregated by facility (Field 5) performing the work or giving the support. Also displayed are WPC, Weapon/Support System Code, and Commodity. Table 12 reflects only those items for which the total excess costs were greater than \$10,000.

The monetary and quantitative categories indicated in the column headings are defined as follows:

$$\text{Total Excess} = (\text{Average Maintenance Cost minus SIP}) \times \text{Production Quantity}$$

Standard Inventory Price = SIP (Positions 65-74)

$$\text{Average Maintenance Cost} = \frac{\text{Fields } 17+19+21+23+25 \text{ to } 35}{\text{Field } 45}$$

Production Quantity = Field 45

Average Work Days = Field 50

TABLE 13

Returns to weapon and support system analysis. Costs (funded and unfunded) accumulated and displayed include all WPCs other than maintenance support WPCs (include Codes A through N in position 82) and are distributed by commodity (as defined previously) and by position 81 of work breakdown structure code, which specifies the component of the system on which maintenance was performed.

In this table the WSSC is converted to the correct nomenclature of the actual weapon or support system and reflected in the first column of the table.

TABLE 14

Identifies items repaired at more than one facility. Specifically, each grouping of rows consists of cases where a unique combination of Item ID (Field 9), Item Name (Field 10), Work Breakdown Structure Code (Field 13) and Work Performance Category (Field 14) occurs at more than one Performing (Field 5) or Reporting Facility (conversion of Field 8). This table includes only workloads having total costs (quantity × unit costs) in excess of $50,000.

The quantitative columns in the table are determined as follows:

Quantity completed = Field 45

Total Cost = Fields 17+19+23+25 to 44

$$\text{Maintenance Cost/Unit} = \frac{\text{Fields 17+19+23+25 to 44}}{\text{Field 45}}$$

APPENDIX G

MANAGEMENT USE OF UNIFORM DEPOT MAINTENANCE COST AND PRODUCTION DATA

Managers will have available to them from the cost and production reporting system a wealth of depot maintenance and maintenance support management data which may be used to:

(1) Develop the depot maintenance and maintenance support work programs;

(2) Measure actual utilization of resources against planned programs;

(3) Provide managerial direction and guidance with respect to the status of programs;

(4) Develop standard unit costs of depot maintenance work;

(5) Compare unit cost incurred to the standard unit cost of work completed;

(6) Compare unit cost incurred with the alternative of replacement cost;

(7) Compare cost among organic depots or between organic and contract sources;

(8) Evaluate depot maintenance and maintenance support activities for efficient use of resources, and identify marginally efficient maintenance activities;

(9) Assist in control of cost over/under-runs.

Reports to the Congress and the general public concerning the consumption of resources in the performance of depot maintenance and maintenance support will be facilitated and made more credible.

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